

Washing machine with a ventilation system

The present invention relates to a washing machine comprising a detergent flushing device and a detergent introduction line running to the washing tub, which has a free connection to the surrounding atmosphere, as well as a supplementary ventilation line connected to the washing tub.

The care agents required for a washing process are deposited in an insert or a drawer of the flushing device before the program begins. The flushing device is usually arranged in the upper area of the washing machine. A plurality of compartments are provided for receiving different types and/or quantities of washing care agents, which are flushed out in an automatically controlled manner during the individual washing program phases by means of fresh water supplied to the washing machine from an external supply network controlled by valves. The water-care agent mixture flows into the washing tub via a flushing hose. The laundry is placed into or removed from the washing machine via the loading opening provided in the appliance housing which can be closed in a watertight fashion by means of a door. The door size is adapted to the laundry drum.

The washing tub with the drum and the flushing container as well as its connections and hose connections are an outwardly sealed closed system when the loading door is closed. Ventilation of the system is usually provided for trouble-free and low-noise operation of the washing machine. This type of ventilation has the effect that pressure equalisation can take place during filling of the washing tub with water or washing solution and during spinning. This is especially necessary for reducing the noise which can occur as a result of compressions during spinning. In addition, the pressure equalisation makes it possible to achieve a higher accuracy during regulation of the liquid level in the washing tub.

In known washing machines, the ventilation is effected via the washing tub or the flushing container. According to a solution described in DE 44 31 075 A1, openings running from inside to outside are provided for pressure equalisation in the upper area of the washing tub. In order to prevent steam or foam from escaping during the program run, condensation devices are additionally provided. DE 196 19 602 A1 is cited as an example of ventilation via

the flushing container. It is proposed therein that the housing of a flushing container should be divided by a separating insert into a flushing area for the water-care agent mixture and a ventilation area for the washing tub. In operative connection with guiding webs moulded in the flushing container housing and running perpendicularly, it is ensured that there is always a free cross-section for the ventilation of the washing tub.

In washing machines with a very large capacity, the loading opening matched to the drum is so wide that children can unintentionally climb into the appliance. The ventilation systems described above are frequently not sufficient to ventilate the washing tub when the washing machine is stopped and the door closed so that children who have climbed in can be protected from suffocation.

For this reason such large washing machines are fitted with additional emergency ventilation. In washing machines of known manufacturers, the emergency ventilation is achieved by means of a hose which is connected to the washing tub in an area located right at the bottom and is guided upwards from there. The opening of the hose which has a free connection to the atmosphere lies above the washing tub or at least near the upper boundary of the washing tub. Such emergency ventilation is simple to achieve and its installation presents no problems in principle. The efficiency of this type of ventilation hose depends on its inside diameter. Adequate ventilation requires a very large inside diameter of the hose. This results in the disadvantage that without additional countermeasures, the operating noise penetrates towards the outside via the hose almost without damping and thus clearly perceptibly increases the noise level. It is also a disadvantage that water vapour and foam can also escape to the outside via the ventilation hose.

It is the object of the invention to provide an improved ventilation system which efficiently fulfils the function of guiding sufficient fresh air into the washing tub and at the same time preventing the escape of water vapour and foam towards the outside and largely suppressing the noise penetrating from inside the appliance towards the outside so that the noise level does not rise noticeably during operation of the washing machine.

According to the invention, the object is solved by said features in the characterising part of claim 1. Further advantageous features of the invention are contained in the dependent claims.

5 As provided by the invention, the supplementary ventilation line is guided from an opening provided as high as possible on the washing tub to a nozzle arranged as high as possible on the detergent flushing device. The detergent introduction line is guided from the detergent flushing device to an upper region of the washing tub located as far as possible from the opening of the ventilation nozzle so that no water reservoir can form in the line. Both lines  
10 are connected to the atmosphere via the detergent flushing device.

In an embodiment of the invention, the detergent flushing device comprises for this purpose on the one hand a lower portion and a cover lying on said lower portion and on the other hand the cover and/or its bearing surface towards the lower portion of the flushing device have air-  
15 permeable spacing compartments in relation to a portion laterally adjacent to the cover and/or to the lower portion.

For sealing the detergent flushing device for protection against spray, according to an advantageous development of the invention, its cover has elevated webs on its underside  
20 which are aligned parallel to the spacing compartments.

The two lines, the detergent supply line and the ventilation line, can best be arranged far from one another by connecting the detergent introduction line to an inlet nozzle arranged on the bottom of the washing tub and by the bottom of the washing tub having a chimney-like recess  
25 in the area of the inlet nozzle.

An important advantage is obtained from the ventilation system according to the invention in that fresh air can be supplied by circulation. For further improvement of the ventilation in one embodiment of the invention a chimney-like extension of the bottom of the washing tub is  
30 provided in the area of the inlet nozzle. The chimney-like extension can advantageously be a component of a shaping which stabilises the washing tub.

As a result of the ventilation of the washing tub configured as defined by the invention, the noise during operation of the washing machine is sufficiently damped. Escape of foam and water vapour are almost completely eliminated because of the large condensing surfaces in the inlet hose and the flushing container as well as the special design of the opening slits in the flushing container.

The invention is explained in detail hereinafter with reference to an exemplary embodiment. The relevant drawings show

- 10 Fig. 1 a washing machine in a cutaway side view,  
Fig. 2 a detergent flushing device in a cutaway front view and  
Fig. 3 a back view of a washing tub constructed according to the invention.

Figure 1 shows a washing machine 1 shown in cross-section from the side. As in Figures 2 and 3, this diagram only shows those components which are important for the functioning of the ventilation system according to the invention. The washing tub 2 and the laundry drum 5 rotatable about a horizontal axis therein have a front loading opening which is accessible from outside via the door 4 in the housing of the washing machine 1. An elastic sleeve seals the washing tub 2 from the housing 1 and the washing tub 2 can be closed in a watertight fashion towards the outside by means of the door 4.

The detergent flushing device 6, a plastic component, is located directly below the cover panel of the washing machine 1 and is accessible for filling with laundry care agents via an opening in the cover 19, which is constructed as a control panel here. The laundry care agent is flushed out in a program-controlled manner using fresh water supplied from an external water supply system via the connection 18.

The bottom of the detergent flushing device 6 has a gradient and discharges in the outlet nozzle 11 for the detergent introduction line 8. This is positioned with respect to the inlet nozzle 7 arranged in the rear upper area of the washing tub casing 2 so that the formation of a water reservoir is eliminated in all cases and thus the flow opening cannot be restricted. The

inlet nozzle 7 is placed on the washing tub 2 so that it is laterally offset by means of a beading 17 formed on the bottom of the washing tub 3.

The ventilation nozzle 9 for the supplementary ventilation hose 10 is attached at the highest position on the front casing edge of the washing tub 2. The corresponding nozzle 12 is likewise formed on the detergent flushing device 6 at a highest possible point.

The hoses 8 and 10 guided from the washing tub 2 to the detergent flushing device 6 are constructed as vibrationally elastic in order to avoid the transmission of vibrations from the spring-suspended washing tub 2 to the detergent flushing device 6 fixedly installed in the housing of the washing machine 1. The connecting nozzles 7 and 9 on the washing tub 2 lie as far as possible from one another at the edges of the washing tub casing 2. The ventilation of the washing tub 2 in the lower area can be accomplished by this arrangement on the shortest path via the perpendicular intermediate compartments formed by the washing tub 2 and the drum 5. The air supply is additionally conveyed by the chimney-like formation of beads 17 which are otherwise formed in a star shape as stabilisation in the bottom of the washing tub 3 (see Figure 3).

The atmospheric connection of the ventilation system is made via air-permeable spacing compartments 14 in the detergent flushing device 6 between the edges of the cover 13 and those of the lid 19 (see Figure 2). In the exemplary embodiment the spacing compartments 14 surrounding the cover 13 are obliquely oriented so that water penetrating into these compartments can flow off more easily. The spacing compartments 14 are formed such that the cover 13 of the detergent flushing device 6 which is fitted into the cover 19 so that the surfaces are flush and is rotatably hinged thereto, only rests on the front corners at two points so that the edge no longer rests on the housing portion 16 or the cover 19 in a circumferentially sealed manner. By means of this measure slot-like spacing compartments 14 are formed on all four sides of the cover 13 via which the ventilation system has free access to the atmosphere. In order to prevent spray water from being able to escape during the water intake, webs 15 aligned parallel to the spacing compartments 14 are formed on the underside of the cover 13.

The large condensing surfaces in the detergent introduction line 8 and the detergent flushing line 6 as well as the special design of the spacing compartments 14 in the detergent flushing device 6 prevent foam and water vapour from escaping during operation of the washing machine 1. The ventilation system according to the invention also has the effect that the noise level during operation of the washing machine 1 is kept within narrow limits.

As can be seen from the exemplary embodiment described, the invention is simple to implement. In particular, no additional components are required and the special arrangements and formations of the substantially known elements used can be achieved using method common in the field. The chimney-like extension 17 of the washing tub bottom 3 in the area of the inlet nozzle 7 as defined by the invention can also be implemented, as shown in the example, without any additional expenditure by means of a recess with shape-stabilising beads 17 which is present in any case.